

ing region Wednesday morning, with the special admonition, "Continue protection of crops." The temperature in the sugar and trucking region of Louisiana Wednesday morning was 24° to 32°, being generally about 27°.

The windrowing of cane was pushed, and notwithstanding that the injury to the crop will reduce the output of sugar nearly one-fourth, the warnings enabled planters to take action which prevented the loss of half the crop. Thus the warnings enabled the saving of one-fourth the entire crop, and as the crop of 1916 was worth \$36,642,240, this shows that the value of the sugar crop saved by these warnings will amount to several million dollars. Nearly half the Irish and sweet potato crops and many of the smaller matured vegetable crops were saved as a result of the warnings given. The great saving of food supplies as a direct result of the advices given by the Weather Bureau in this instance can hardly be estimated.

Weather warnings were issued for rice and alfalfa interests for 84 hours in advance on October 3, 4, 5, 9, 10, 11, 16; and for 60 hours in advance on the 2d, 6th, 8th, 12th, 13th, 15th, 19th, 31st. All these warnings were verified.

Fire-weather warnings were issued on the 22d and 28th: weather and winds occurred as forecast.—*I. M. Cline, District Forecaster.*

*Denver forecast district.*—The weather was exceptionally dry, except in north-central Colorado, where frequent rain or snow fell. Several regular observing stations in the district reported no appreciable precipitation. The month was marked by extremes of temperature, a severe cold wave occurring on October 29, with temperature readings in Colorado lower than ever before recorded in that State in October; hot weather prevailed in southwestern Arizona on the 5th and 6th, when the highest temperatures of record at Phoenix for those dates, 104°, was reached.

Frost warnings were issued for considerable areas in Colorado and New Mexico on the 7th, 8th, 9th, 11th, 13th, and 14th, and were generally fully verified.

Fire-weather warnings were issued on several dates and were verified in localities, notably on the 17th, when the fire-weather station on the western slope in Colorado reported a 24-hour wind movement of 800 miles.

Warnings of freezing temperature or killing frost were issued for Colorado, Utah, northern New Mexico, and northern Arizona on the morning of the 17th. The warnings were fully verified. Similar warnings were repeated for the same area the following morning and extended to include southeast New Mexico. Freezing temperatures again occurred and killing frosts were reported at Salt Lake City, Santa Fe, and as far south as Roswell, N. Mex. The temperature fell to 28° in eastern New Mexico and was much lower in northwest New Mexico.

Another anticyclone having overspread the northern Rocky Mountain region on the morning of the 20th, freezing temperatures were predicted for Colorado. Freezing temperatures occurred in the early part of the night. On the morning of the 21st warnings of decidedly colder weather, with temperatures considerably below the freezing point, were issued for north-central Colorado. By the evening of the 21st an anticyclone was spreading southward over Montana, and cold-wave warnings were issued for eastern Colorado. At this time temperatures were well above 60°. On the 22d temperatures were 20 to 30 degrees lower in eastern Colorado and considerably below the freezing point by night. On the morning of the 22d freezing-temperature warnings were extended to cover eastern New Mexico, and were verified.

A cyclone of marked intensity appeared over western Montana at 6 a. m. on the 27th and moved southeastward to Idaho by the evening of the 27th, when an anticyclone covered Alberta. Cold-wave warnings were issued on the evening of the 27th for eastern Colorado, with advices of decidedly colder weather. At 6 a. m. Sunday morning, the 28th, cold-wave warnings were extended to western and southern Colorado, northeast Arizona, and southwest Utah, with the advice that decidedly colder weather was indicated. Notice of much colder weather was also sent to Salt Lake City. The warnings were timely, as decidedly colder weather overspread the greater part of the district. In a large part of Colorado the temperatures on the morning of October 29 were lower than ever before recorded in Colorado in October. As a result of the warnings of the 27th and 28th, apple picking was rushed and picked fruit, potatoes, etc., that had been dug and were exposed in the fields were placed in storage or gathered in piles in the fields and covered. Some were lost, however, on account of the scarcity of labor and it is estimated that 5 per cent of the potato crop was frozen in the ground. Fortunately, by far the greater portions of the fruit and potato crops had been gathered before the freeze. At 6 p. m. of the 28th cold-wave warnings were extended to include eastern New Mexico. The following morning temperatures were much lower in New Mexico, but were still several degrees above the previous low-temperature records in that region.—*Frederick W. Brist, Assistant Forecaster.*

*San Francisco forecast district.*—The controlling features of the weather in this district during the month, were the frequent recurrence of high pressure areas over the Plateau and Rocky Mountain regions and the persistency off the north Pacific coast of the Pacific Ocean permanent high. This distribution of pressure caused the depressions from the north Pacific to pass eastward at a high latitude. The result was but little precipitation west of the Rocky Mountains and south of the international boundary, nearly all of it being confined to the western portion of Washington. The month was one of the driest Octobers on record in the Pacific Coast States.

Southeast storm warnings were issued on the 1st, from the mouth of the Columbia River north. Small-craft warnings on the 8th for the Strait of Fuca. Northwest warnings on the 27th, at the Strait of Fuca and mouth of Columbia River with small craft warnings at other Washington stations; and southeast warnings at the Strait of Fuca with advisory at other northern stations except Marshfield on the 28th. The warnings were but partly verified as the storms moved inland at a higher latitude than was expected.

Warnings of heavy to killing frosts were issued on the 16th, 17th, and 18th for Washington, Oregon, and Idaho, and killing frosts occurred except near the coast.

Fire-weather warnings were issued in California on the 3d, 17th, and 25th, and were justified.—*G. H. Willson, District Forecaster.*

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#### TROPICAL HURRICANE OF SEPTEMBER 27-28, 1917, IN SOUTHEASTERN LOUISIANA.

By RAY A. DYKE, Assistant Forecaster.

[Dated: Weather Bureau Office, New Orleans, La., Oct. 13, 1917.]

The tropical storm that occurred during the last week of September, 1917, was of more than ordinary extent and severity, as appeared when the western segment of the hurricane passed over extreme southeastern Louisiana on the 28th.

## WARNINGS.

Ample notice of the presence of the storm was given in advisory messages, beginning on the 22d. On the 25th we were notified that hurricane warnings were hoisted from Apalachicola to Mobile and that all places on the coast from Mobile to New Orleans were advised to take all necessary precautions. These messages were radio-graphed to vessels at sea and all interests affected were kept fully advised.

Storm warnings were ordered for the Louisiana coast on September 26, as follows:

Hoist northeast storm warning 4:30 p. m., Burrwood, Empire, Pilot-town, and Morgan City, La., for shipping and fishing interests. Tropical disturbance in middle east Gulf will cause increasing northeast winds.

(Signed) DYKE.

The following message was received at 9:30 p. m. on the 26th:

Hoist hurricane warning 10 p. m., Pascagoula to New Orleans. Single radio report to-night from east-central Gulf indicates some possibility that the tropical storm may approach the coast a little farther west than appeared probable Tuesday, beginning some time Thursday morning. Impossible to locate center of disturbance and hurricane warnings therefore now displayed from New Orleans to Apalachicola.

(Signed) FRANKENFIELD.

This warning was immediately transmitted to our storm-warning displaymen, with instructions to distribute thoroughly; and was disseminated by motor boat throughout the Barataria Bay section and to Grand Isle. The city police and fire departments assisted in the distribution of the warning in New Orleans and the daily papers gave the warning prominence. All persons were advised to take precautions against dangerous winds and high tides.

The following warning received on the morning of the 27th, was given the fullest possible distribution:

Hoist hurricane warnings along central and eastern Louisiana coasts beyond New Orleans, also inland storm warnings for southeast Louisiana. Disturbance this morning apparently central about 150 miles southeast of the mouth of the Mississippi River, moving north-north-west.

(Signed) FRANKENFIELD.

This warning was sent to all telephone exchanges in southeastern Louisiana, and Superintendent T. B. Baird of the Cumberland Telephone & Telegraph Co. instructed managers to give the warning the widest possible distribution. Both the Western Union and the Postal Telegraph companies and the Louisville & Nashville Railroad Co. had the warning telegraphed to their offices along the middle Gulf coast, instructing their agents to notify persons in exposed places to seek secure locations, and to warn oyster and fishing interests to keep their fleets in off the Gulf. Complete distribution was effected at and in the vicinity of New Orleans.

A message from the supervising forecaster at 9 p. m. of the 27th stated that it appeared probable that the storm would reach the Louisiana coast Friday morning, the 28th. This prediction was in accord with the hurricane warnings and was given appropriate distribution.

The Weather Bureau office was open to the public during the night of the 27th-28th.

In order that precautions in southeastern Louisiana on the 28th might not be relaxed until danger from the storm was definitely past, the following warning was issued:

Advisory warning, Louisiana coast, 8:30 a. m.: Tropical disturbance central at mouth of Mississippi River, apparently short distance south-

east of Pilottown. Northerly gales, probably reaching hurricane force in southeastern Louisiana, with high tides to-day and to-night. Strong northwest winds on western Louisiana coast.

(Signed) DYKE.

In the distribution of this warning, particular attention was given to exposed places along and east of the Mississippi River.

The New Orleans Item, of September 28, 1917, comments as follows on the distribution of the warnings:

Whatever damage this gale may ultimately do, wherever it passes, will be largely unavoidable. Nobody in Louisiana or Mississippi is going to be caught unawares who can be reached by ordinary means of communication and by the extraordinary measures adopted by the Weather Bureau and by other public and private agencies to inform outlying places and persons.

The Weather Service has further commended itself to the people of the Gulf South in its ample warnings against the approaching disturbance. In view of the fact that Gulfport reports a gale of 50 miles \* \* \* nobody along the eastern and middle Gulf coast will have the hardihood to find fault with hurricane warnings there because these warnings were not followed by the hurricane itself. \* \* \*

Dr. Cline and his assistants have been the center of a disturbance all their own during the past few days, the locus of it being definitely established in the Federal building on Camp Street. Their department is rendering the country and its shipping great service in this as in similar visitations. Their service becomes more valuable as the department's facilities are extended in the Indies and the Caribbean.

## METEOROLOGICAL CONDITIONS AND EFFECTS OF THE HURRICANE.

At New Orleans the pressure fell gradually during September 27, 29.77 inches being recorded at 7 p. m. The wind was northeast except for a few hours near noon, when it was east and southeast. The velocity increased from gentle to moderate. Lower clouds predominated, moving from the east and northeast; but 1/10 cirro-stratus from the southwest, was observed in the early morning. The sky was overcast in the afternoon, and rain from 1:22 to 2:45 o'clock was attended by unusually dark clouds and a sharp fall in temperature.

The pressure was lowest between 3 a. m. and 3 p. m. on the 28th, varying slightly during this time, the minimum being 29.61 inches. The wind velocity did not exceed 30 miles an hour at New Orleans, notwithstanding that hurricane winds were blowing at the mouth of the Mississippi River from 2 a. m. to 9 a. m., and the barometer column descended to 28.91 inches at Port Eads, at 6:30 a. m. The wind direction at New Orleans changed from northeast to north at midday and to northwest at 3 p. m. and the velocity diminished in the afternoon.

The river, which was low, rose from 5.2 feet, on the 26th, to 6.6 feet, on the 28th, after which it fell to 4.1 feet, on the 30th. The tide at Grand Isle and Port Eads was 4 feet above normal.

In order to show the conditions when the center of the disturbance was nearest the Louisiana coast, reports from the Mississippi River passes have been combined with the daily weather map. That the path of the center was close to Port Eads is made apparent by the accompanying figure 1 showing barometric pressure and wind directions in Louisiana at 7 a. m., September 28. Figure 2 shows the location of places on the lower river.

East winds were observed at the mouth of the river until about 3 a. m., after which there was a gradual change to northeast. During the height of the storm the directions were northeast and north-northeast. In the early afternoon the wind became northwest.

At Port Eads the anemometer of the United States Engineers' office registered until 7:10 a. m. of the 28th, when the exposed part blew away, just after recording 84 miles an hour. Mr. O. O. Melancon, junior engineer,

on duty at Port Eads at the time, estimates that between 7 a. m. and 9 a. m. the velocity reached 90 to 100 miles an hour. The highest velocities at the special Weather Bureau station at Burrwood were recorded between 5 a. m. and 9 a. m., the maximum velocity for a 5-minute period being 80 miles an hour at 5:40-5:45 a. m. A velocity of 79 miles an hour was recorded at 8:10-8:15 a. m.

It is probable that hurricane winds did not occur much farther up the river than Fort St. Philip, although there was considerable damage to the rice, sugar, and orange crops farther north in Plaquemines Parish. The greatest damage to crops was on the eastern side of the river. The western side escaped with small loss. This hurricane was like its predecessors, in that, when it reached the land, the wind velocities near the rim of the

lodges of some hunting clubs suffered considerable damage. The western bank of the river was littered in places with the fragments of broken houses, and the bodies of dead animals, including cattle, horses, dogs, goats, and hogs, were seen along the lower river soon after the storm.

The early and thorough distribution of the warnings caused all kinds of craft to be placed in safe waters, and damage to shipping was exceedingly slight, other than that of the small boats already referred to. The bayous and canals provided a good refuge for boats.

In places subject to danger from high water along the Mississippi River and near Lakes Borgne and Pontchartrain people moved out, and there is no doubt that many lives were thus saved by the warnings. So far as

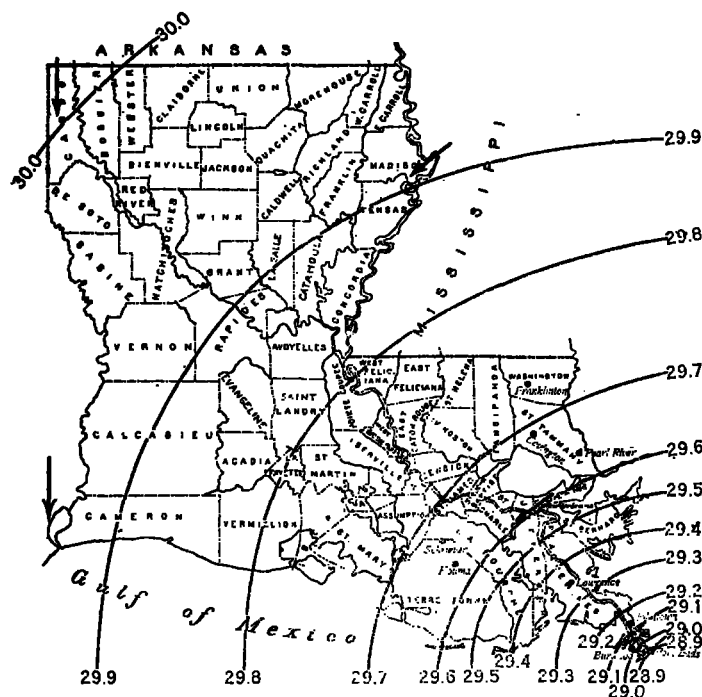


FIG. 1.—Map of Louisiana, showing isobars and a few wind directions at 7 a. m. September 28, 1917.

western segment were much less than the barometric gradient would indicate.

The precipitation was excessive only in the vicinity of the Passes and did not extend far inland. The fall at Burrwood on the 27th-28th was 6.40 inches.

Maj. Frank M. Kerr, of the Louisiana State Board of Engineers, reports that 3 miles of levees on the east bank south of Nicholls and 2½ miles between Boothville and Venice, on the west side, will require new earthwork and wood revetment as a result of the storm. The levees that were damaged on the eastern bank were struck by the Gulf waters from Breton Sound.

Below Buras numerous buildings were dislodged from their foundations, and several houses and barns were blown down. One building of considerable size was carried by wind and water through the levee and was left on the river bank. Fishermen along the lower river lost some of their small boats, but most of the boats were stranded and can be refloated. Fishing camps and the

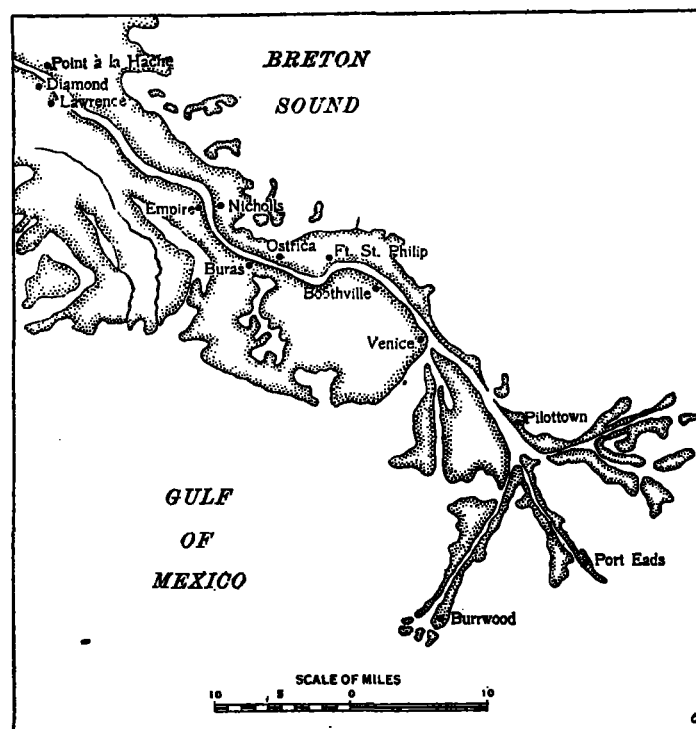


FIG. 2.—Stall diagram showing relative locations of points on the lower stretch of the Mississippi.

can be learned the only loss of life was that of an 8-year old boy named James Ohenio, who, while walking along Bayou St. John, near New Orleans, was caught by a gust of wind, lost his footing, fell into the water, and died soon after being pulled out. This incident might have occurred with any strong wind.

Train service to Mobile was interrupted on the 28th and part of the 29th because of the washing out of the ballast under the Louisville & Nashville track near Lake Catherine, about 30 miles northeast of New Orleans. The movement of vessels toward east Gulf and Caribbean ports had ceased on the 24th. Sailings of vessels from New Orleans in all directions were cancelled on the 26th and 27th.

Early in the afternoon of the 28th we were able to announce that the storm had passed on the eastern side and that all danger in New Orleans was definitely over. Shipping was soon afterwards advised that it was safe to proceed.